to be enabled to place before our eyes, so to speak, the actual motion of the revolving body, yet it is not on such grounds that the paper is presented to this Society. It is as a method of investigation that it must rest its claims to the notice of mathematicians; as a means of giving simple and elegant interpretations of those definite integrals on the evaluation of which the dynamic state of a body at any epoch can alone be ascertained.

In these applications of the theory of elliptic functions, the author has been led to the remarkable theorem, that the length of the spiral, between two of its successive apsides, described in absolute space on the surface of a fixed concentric sphere, by the instantaneous axis of rotation, is equal to a quadrant of the spherical ellipse described on an equal sphere moving with the body, by the same instantaneous axis of rotation.

The last section of the paper is devoted to the discussion of that particular case in which the axis of the invariable plane is equal to the mean semiaxis of the ellipsoid of moments.

February 15, 1849.

W. R. GROVE, Esq., Vice-President, in the Chair.

A paper was in part read, entitled "Description of an Infusory Animalcule allied to the genus Notommata of Ehrenberg, hitherto undescribed." By John Dalrymple, Esq., F.R.C.S. Communicated by Thomas Bell, Esq., Sec. R.S.

February 22, 1849.

GEORGE RENNIE, Esq., Treasurer, Vice-President, in the Chair.

The Right Honourable Sir Francis Baring, Bart., First Lord of the Admiralty, was balloted for and duly elected into the Society.

The reading of a paper, entitled "Description of an Infusory Animalcule allied to the genus Notommata of Ehrenberg, hitherto undescribed." By John Dalrymple, Esq., F.R.C.S. Communicated by Thomas Bell, Esq., Sec. R.S., was resumed and concluded.

The examination of various specimens of the animalcule described by the author, disclosed the dicœcious character of one of the more highly organized of the rotiferous class of Infusoria, hitherto supposed to be androgenous. This discovery was first made by observing the difference in the form and development of the embryo while still enclosed in the ovisac of the parent animal. From the extreme transparency of this form of rotifer, it is possible to trace the progressive development of the young from the Græffian vesicle in the ovary to the period of mature gestation, when the embryo is

expelled, the whole machinery of whose organs has been perfected while still within the body of the female.

Thus, although the young one observed in the ovisac, when nearly ready to be expelled, was in the great majority of instances a miniature portrait of the parent, yet occasionally an embryo was seen of a different aspect, within whose body a vesicle was discovered filled with actively moving spermatozoa.

A further investigation of the subject brought clear evidence of the functions performed by this male,—its copulation with the young females; but it also displayed the singular fact, that although the organs of reproduction and locomotion were highly developed, there was a total absence of those of assimilation; in fact, that neither mouth, nor stomach, nor other digestive cavity or glands, were present in its curious organization.

In the early part of the paper the author describes the anatomy of the female, which differs from the family of Notommata of Ehrenberg, in the absence of intestine and anal orifice, and forcipated or caudal foot. In every other respect the organization is so similar to that class, that the author believes the proper place for this animalcule to be in a *sub-genus* of Notommata.

In relation to physiology, the author submits a new theory of the mechanism of circulation and respiration in the general group of Rotifers, a subject which is but obscurely treated of by the great German observer, who appears to have believed in the existence of tubular vessels or true vascular system. The author thinks, however, that these functions are performed in a manner more resembling that of insects, viz. that the blood is contained in the general cavity of the animal and circulates round the lung, which is here represented by a contractile vesicle that receives and expels the water in which the animalcule lives, and so comes to be in intermediate relation with the air mixed with the water. The difference therefore between the aëration of the blood of insects and that of this rotifer is rather due to the difference of the media they respectively inhabit, than of design. In both, the blood is contained in a general cavity and brought in contact with the air, without the intervention of any true vascular system.

The beautiful transparency of the animal, and the facility with which the development of the ovum may be traced through all its stages, induces the author to believe it to be well-suited to the inquiries of the embryologist and of those who devote themselves to the study of the metamorphosis of cell into tissue.

This animalcule has hitherto been discovered only in a few situations (in Norfolk near Norwich, and in Warwickshire near Coventry), but it is believed, from the very general dispersion of Infusoria, that it may be more extensively met with, especially in the months of June, July, August and beginning of September.

The author concludes by expressing his belief that re-examination of the whole order of Rotifera is necessary to determine the disposition of the sexes, and to assign them their proper situation in the scale of animated beings.

A paper was also read, entitled "On the Integration of Linear Differential Equations." By the Rev. Brice Bronwin. Communicated by C. J. Hargreave, Esq., F.R.S.

The method chiefly employed in this paper, is analogous to one which the author had previously applied (Camb. Math. Journal, No. 4) to the integration of such equations in cases where the coefficients are integer functions of the independent variable. Here they are any functions of that variable, it being however understood that in all integrable cases there must be some relation among these coefficients. The integration is effected by a general theorem of the form

$$\mathrm{D}^n f(\varpi_{m+n})u = f(\varpi_m)\mathrm{D}^n u,$$

where D denotes any function of x, and ϖ a function of symbols both of operation and quantity. By means of this theorem, and the substitution $u = \varpi_1 \varpi_2 \ldots \varpi_n v$, or some other similar one, the equation is either reduced to an integrable form, or to an equation of a lower order; or, when neither of these objects can be accomplished, the method may be employed to effect a transformation.

The method applies most readily to equations of the second order; but may be applied to those of a higher order, the coefficients becoming more restricted as the order rises. The integrable cases are very numerous and vary considerably in form; and, as each distinct form requires a variation in the process, they are distributed into classes. In each class, a few particular examples, derived from the general cases, are given.

By means of the general theorem, the equation

$$\varpi_m \varpi_n u + p\rho u = \mathrm{X}$$

may be integrated in the most general case, or when the coefficients are any functions of x, having, however, certain relations between them.

Several theorems of the form $\pi_n \rho u = \rho \pi_{n-1} u$, where $\rho = \mathrm{D} + \theta$, $\pi_n = \mathrm{D}^2 + \mathrm{A}_n \mathrm{D} + \mathrm{B}_n$, or similar to it, are given. They are not found without difficulty; are much more restricted in their application than the general theorem; and lead to but few results; but they are deserving of notice on the ground that they may possibly succeed in a particular case when all other methods fail.

A few general examples of a class of equations, the solution of which is attended with considerable difficulty, are next given. These are of the forms,

$$\mathrm{D}\varpi^2 u + b\varpi^2{}_n u = \mathrm{X}, \quad \mathrm{D}^2 \varpi^2{}_n u + b\varpi^2{}_{n+m} u = \mathrm{X},$$

and others varying a little from them.

The concluding part of the paper is occupied with the transformation and application of one or two of the general theorems which have been given by the author in the Cambridge Mathematical Journal, New Series, vol. iii., from which a few examples, more or less particular, have been derived.